Range Cattle Research and Education Center
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CLIMATOLOGICAL REPORT 2004

Range Cattle Research and Education Center

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Weather conditions strongly influence agricultural operations from planting through harvesting. Knowledge of annual rainfall and temperature cycles along with their extremes help producers determine optimum times to prepare and plant seedbeds, fertilize pastures, apply herbicides, control water, and to supplement cattle on pasture or range. Weather conditions influence germination, forage growth, palatability, and nutritive value. A knowledge of weather cycles and extremes is helpful to a successful cattle operation.

This research report presents a summary of rainfall, air temperature, evapotranspiration, and solar radiation for 2004 obtained at the Range Cattle Research and Education Center (REC) Ona, Florida. The center is located 82^{o} 55' W and 27^{o} 26' N in south central Florida approximately 45 miles (72 km) east of the Gulf of Mexico and 100 miles (160 km) west of the Atlantic Ocean.

Weather observations were collected with a Weather Watch 2000 (Campbell Scientific, Inc). Accuracy of rainfall as measured by the Weather Watch 2000 was checked by comparing with rainfall measured by a US Weather Service standard gauge. Measurements reported here were taken at 0900 h, thus data on a given day represent the previous 24-h period.

Rainfall:

Annual rainfall for 2004 was 65.14 inches, which was 11.16 inches (21%) greater than the 63-year average of 53.98 inches (standard deviation 11.09 inches) (Table 1). The year with the least rainfall was 2000 when 32.02 inches were measured, and the year with the greatest rainfall was 1959 when 78.82 inches were recorded.

Monthly rainfall totals for March and April were below the 63-yr means for these months, indicating conditions were drier than normal for pasture growth (Table 1, Figure 1). May 2004 rainfall exceeded the 63-yr mean, however, this was not effective rainfall

because 99% of the monthly rain was received in the first 4 d of May. Less than normal rainfall in June and July was actually beneficial for cattle because pastures were not excessively wet. Rainfall in August and September far exceeded the 63-yr mean because of hurricanes Charley, Frances, and Jeanne, and pastures were flooded. Rainfall in the 72-h period associated with hurricane Charley (12-14 August) was 5.98 inches, Frances (4-6 September) was 5.53 inches, and Jeanne (25-27 September) was 6.18 inches. Were it not for these three hurricanes, 2004 would have been relatively dry.

There were 18 occurrences during 2004 when daily rain equaled or exceeded 1 inch, nine rain events that exceeded 2 inches, five events that exceeded 3 inches, and three events that exceeded 4 inches of rain (Table 2). The single greatest daily rain event was 14 August when 4.19 inches were recorded.

Table 1. Summary of rainfall by months. Range Cattle REC, 2004.

	1942 to 2004			2004	
	Maximum month	Minimum month	63-yr Average†	Total	Diference from 63-yr average†
	- - - - - - - - - - - - - - inches* - - - - - - - - - - - - - -				
January	8.45	0.03	2.19	1.45	-0.74
February	9.59	0.02	2.60	4.70	+2.10
March	12.34	0.13	3.18	0.37	-2.81
April	11.91	0.00	2.51	1.46	-1.05
May	10.58	0.00	3.76	6.98	+3.22
June	18.99	2.79	8.52	5.34	-3.18
July	19.74	1.87	8.47	6.41	-2.06
August	15.72	3.13	8.23	16.10	+7.87
September	20.11	1.14	7.48	16.36	+8.88
October	11.23	0.04	3.07	0.79	-2.28
November	11.22	0.07	1.95	1.32	-0.63
December	8.61	0.16	2.02	3.86	+1.84
Year total			53.98	65.14	+11.16

*Inches x 2.54 = cm.

† Since rainfall records began in July 1942, means for January to June are 62-yr means.

Table 2. Daily minimum and maximum temperature, precipitation, and solar

radiation for 2004, Range Cattle REC.

	January				February				March				April			
Day	Max	Min	Rain	MJ/	Max	Min	Rain	MJ/	Max	Min	Rain	MJ/	Max	Min	Rain	MJ/
	°F	°F	inches	m^2	°F	°F	inches	m^2	°F	°F	inches	m^2	°F	°F	inches	m^2
1	81	57	0.00	13.82	65	55	0.87	3.46	76	59	0.00	18.14	79	55	0.00	27.65
2	79	58	0.00	11.23	78	56	0.01	9.50	77	59	0.00	13.82	69	42	0.00	28.51
3	80	58	0.00	11.23	73	50	0.01	11.23	81	60	0.00	16.42	73	48	0.00	27.65
4	81	61	0.00	12.96	76	54	0.00	16.42	81	60	0.00	13.82	75	45	0.00	28.51
5	83	57	0.00	12.96	80	61	0.00	16.42	83	64	0.00	16.42	75	47	0.00	27.65
6	81	56	0.00	13.82	84	66	0.02	15.55	85	62	0.00	14.69	79	47	0.00	25.92
7	81	48	0.00	12.96	85	62	0.11	14.69	84	66	0.00	19.87	83	53	0.00	26.78
8	63	44	0.00	14.69	66	41	0.04	11.23	82	57	0.00	16.42	81	57	0.00	20.74
9	73	48	0.00	15.55	60	44	0.00	19.87	73	41	0.00	23.33	83	61	0.00	20.74
10	77	52	0.08	12.96	78	56	0.00	18.14	70	48	0.00	20.74	84	62	0.00	19.01
11	52	37	0.00	4.32	82	58	0.00	15.55	68	42	0.00	25.06	86	55	0.00	24.19
12	66	43	0.00	17.28	82	59	0.00	12.96	74	47	0.00	25.06	88	66	1.03	19.01
13	72	42	0.00	16.42	83	66	0.00	14.69	76	48	0.00	22.46	78	64	0.23	7.78
14	69	36	0.00	16.42	72	63	0.01	6.05	78	54	0.00	24.19	77	51	0.00	18.14
15	69	46	0.00	16.42	80	66	1.28	7.78	80	61	0.00	16.42	67	43	0.00	25.06
16	72	43	0.00	11.23	72	51	0.01	12.96	83	67	0.01	12.10	74	44	0.00	29.38
17	72	45	0.01	16.4	64	54	0.00	12.1	73	64	0.36	7.78	78	53	0.00	25.9

				2				0								2
18	76	55	0.19	12.10	63	41	0.00	9.50	79	50	0.00	23.33	79	54	0.00	26.78
19	73	60	0.86	6.91	62	35	0.00	21.60	82	56	0.00	24.19	81	55	0.00	27.65
20	76	50	0.02	10.37	71	46	0.00	20.74	83	57	0.00	24.19	82	52	0.00	25.92
21	63	39	0.00	17.28	73	58	0.00	10.37	82	55	0.00	20.74	81	56	0.00	25.92
22	71	40	0.00	15.55	78	51	0.00	14.69	82	57	0.00	25.06	81	58	0.00	20.74
23	69	40	0.00	17.28	80	53	0.00	19.01	76	49	0.00	25.92	86	61	0.00	25.92
24	66	34	0.00	17.28	82	65	0.00	17.28	74	53	0.00	23.33	87	58	0.00	25.06
25	72	42	0.00	17.28	83	62	1.70	15.55	73	56	0.00	18.14	87	65	0.00	26.78
26	77	54	0.00	16.42	68	62	0.63	3.46	77	60	0.00	19.87	86	62	0.00	25.92
27	82	67	0.05	12.96	75	52	0.01	16.42	80	60	0.00	22.46	87	66	0.00	25.06
28	76	46	0.00	12.96	55	43	0.00	5.18	82	57	0.00	24.19	79	52	0.00	14.69
29	62	32	0.00	18.14	70	47	0.00	19.01	82	53	0.00	24.19	84	68	0.00	28.51
30	70	50	0.00	12.96					82	49	0.00	23.33	83	69	0.20	13.82
31	65	53	0.24	4.32					81	56	0.00	25.06				
Avg	73	48		13.63	74	54		13.50	79	56		20.35	80	56		23.85
Max	83	67	0.86	18.14	85	66	1.70	21.60	85	67	0.36	25.92	88	69	1.03	29.38
Min	52	32	0	4.32	55	35	0	3.46	68	41	0	7.78	67	42	0	7.78
Total			1.45	422.50			4.70	391.41			0.37	630.74			1.46	715.41

Table 2. Continued

	May				June				July				August			
Day	Max	Min	Rain	MJ/	Max	Min	Rain	MJ/	Max	Min	Rain	MJ/	Max	Min	Rain	MJ/
	°F	°F	inches	m^2	°F	°F	inches	m^2	°F	°F	inches	m^2	°F	°F	inches	m^2
1	90	67	4.04	19.87	94	68	0.00	25.92	91	71	0.00	22.46	91	74	0.02	18.14
2	88	69	1.39	24.19	95	69	0.00	28.51	94	74	0.00	25.92	88	75	0.13	12.10
3	88	72	0.00	22.46	94	67	0.16	25.06	92	69	0.00	19.87	84	75	0.13	15.55
4	78	66	1.46	8.64	95	66	0.00	24.19	93	71	0.75	19.87	86	75	0.24	14.69
5	81	59	0.00	27.65	90	68	0.06	17.28	93	72	0.08	22.46	84	74	0.52	9.50
6	81	57	0.00	28.51	88	67	0.14	19.87	94	71	1.27	22.46	90	75	0.04	19.87
7	86	62	0.00	26.78	92	66	0.04	24.19	94	70	0.00	22.46	91	77	0.00	21.60
8	86	59	0.00	26.78	92	70	0.08	23.33	90	66	0.01	17.28	88	75	0.55	13.82
9	84	64	0.00	28.51	92	71	0.00	23.33	93	69	0.00	24.19	85	74	0.07	9.50
10	85	62	0.00	24.19	91	70	0.01	19.01	95	70	0.00	25.06	92	73	0.00	19.87
11	80	66	0.00	13.82	91	70	0.36	21.60	95	71	0.00	25.06	94	73	0.00	24.19
12	85	67	0.00	19.01	90	72	0.32	17.28	93	70	2.09	19.87	93	73	0.03	19.01
13	86	65	0.00	23.33	92	71	0.00	24.19	92	72	0.00	25.06	91	72	0.55	19.87
14	86	66	0.00	26.78	93	71	1.11	21.60	91	72	0.09	20.74	87	73	4.19	7.78
15	86	65	0.00	25.06	92	71	0.23	19.01	90	73	0.00	25.92	90	72	0.94	14.69
16	89	67	0.00	25.06	91	72	0.62	19.01	88	73	0.13	15.55	93	72	0.00	21.60

17	86	68	0.00	22.46	91	71	0.00	19.87	89	72	0.02	17.28	93	73	0.53	19.01
18	87	64	0.09	23.33	91	72	0.00	22.46	86	75	0.14	13.82	94	72	3.62	19.87
19	87	65	0.00	25.06	91	73	0.00	23.33	88	73	0.41	18.14	93	73	2.64	20.74
20	86	65	0.00	25.92	91	73	0.00	25.92	79	74	0.91	6.05	93	74	0.77	20.74
21	89	64	0.00	26.78	91	72	0.00	23.33	81	71	0.28	6.91	93	74	0.09	20.74
22	89	65	0.00	25.92	90	72	0.00	23.33	90	71	0.00	19.87	96	76	0.10	19.01
23	90	63	0.00	26.78	92	67	0.00	25.06	92	71	0.00	24.19	94	74	0.01	21.60
24	89	63	0.00	27.65	97	68	0.54	25.92	93	73	0.00	24.19	90	75	0.20	15.55
25	90	62	0.00	26.78	94	71	0.43	21.60	93	73	0.01	25.06	88	74	0.00	13.82
26	92	64	0.00	29.38	94	71	0.00	24.19	93	72	0.00	20.74	91	73	0.00	21.60
27	82	67	0.05	12.96	75	52	0.01	16.42	90	72	0.01	15.55	93	74	0.04	18.14
28	91	64	0.00	25.06	92	71	0.12	20.74	90	72	0.13	16.42	92	71	0.00	17.28
29	91	66	0.00	28.51	92	71	0.24	20.74	89	73	0.07	16.42	92	74	0.00	23.33
30	91	68	0.00	23.33	90	70	0.42	14.69	89	74	0.00	22.46	92	74	0.00	24.19
31	92	67	0.00	20.74					92	72	0.01	22.46	93	73	0.69	17.28
Avg	87	65		24.41	92	70		22.26	91	72		20.12	91	74		17.89
Max	94	72	4.04	29.38	97	73	1.11	28.51	95	75	2.09	25.92	96	77	4.19	24.19
Min	78	57	0	8.64	88	66	0	14.69	79	66	0	6.05	84	71	0	7.78
Tot			6.98	756.			5.34	667.			6.41	623.			16.1	554.

al				85				89				79			0	68

Table 2. Continued

	September				October				November				December			
Day	Max	Min	Rain	MJ/	Max	Min	Rain	MJ/	Max	Min	Rain	MJ/	Max	Min	Rain	MJ/
	°F	°F	inches	m^2	°F	°F	inches	m^2	°F	°F	inches	m^2	°F	°F	inches	m^2
1	96	69	1.25	22.46	91	72	0.00	20.74	86	67	0.00	18.14	81	64	0.00	14.69
2	92	75	0.01	18.14	91	72	0.00	19.87	87	67	0.00	12.96	81	59	0.00	13.82
3	91	75	0.04	16.42	90	70	0.00	20.74	87	65	0.00	15.55	75	53	0.00	6.05
4	92	73	0.01	23.33	90	70	0.00	21.60	89	68	0.00	16.42	71	44	0.00	14.69
5	87	72	0.79	11.23	91	72	0.00	19.87	86	66	0.03	15.55	75	50	0.00	12.10
6	82	73	4.11	3.46	90	73	0.00	19.01	74	56	0.01	16.42	78	59	0.00	12.96
7	88	76	0.63	12.10	88	72	0.00	17.28	79	53	0.00	17.28	83	62	0.00	13.82
8	86	77	0.20	16.42	84	66	0.00	14.69	79	49	0.00	19.01	80	62	0.00	9.50
9	89	74	0.52	15.55	87	66	0.00	19.01	78	51	0.00	18.14	84	64	0.00	10.37
10	92	74	1.93	19.01	88	70	0.00	19.01	81	62	0.15	12.10	85	66	0.00	11.23
11	91	75	0.00	20.74	86	73	0.01	11.23	81	61	0.00	17.28	80	57	0.31	6.05
12	90	74	0.00	20.74	80	69	0.78	6.05	82	62	0.00	14.69	72	37	0.00	12.10
13	91	76	0.00	19.87	88	67	0.01	17.28	83	60	0.00	14.69	64	40	0.00	15.55
14	89	78	0.01	13.82	83	63	0.00	17.28	82	66	0.00	10.37	76	51	0.05	14.69
15	85	79	0.00	7.78	84	64	0.00	19.87	78	59	0.00	8.64	62	34	0.00	15.55

16	88	77	0.00	10.37	84	53	0.00	13.82	79	60	0.00	13.82	60	41	0.00	15.55
17	92	77	0.00	20.74	79	54	0.00	21.60	77	55	0.00	12.96	70	52	0.00	12.96
18	90	74	0.00	21.60	83	63	0.00	20.74	78	55	0.00	15.55	66	56	0.32	5.18
19	91	71	0.00	19.87	87	69	0.00	14.69	80	53	0.00	14.69	71	45	0.00	8.64
20	90	71	0.03	18.14	87	68	0.00	12.10	81	57	0.00	15.55	67	42	0.00	13.82
21	82	72	0.40	8.64	88	71	0.00	14.69	82	56	0.00	15.55	56	34	0.00	15.55
22	82	74	0.25	9.50	88	66	0.00	17.28	84	60	0.00	16.42	71	48	0.00	14.69
23	86	70	0.00	15.55	84	66	0.00	16.42	84	61	0.00	13.82	77	63	0.00	11.23
24	89	70	0.00	19.87	84	60	0.00	15.55	81	65	0.00	10.37	74	60	0.09	3.46
25	88	70	0.00	19.87	83	64	0.00	18.14	84	71	0.18	12.10	63	52	0.33	2.59
26	85	75	3.51	12.10	85	64	0.00	18.14	77	47	0.00	12.96	69	50	2.76	0.86
27	82	76	2.55	5.18	84	63	0.00	17.28	71	53	0.00	16.42	54	37	0.00	10.37
28	87	74	0.12	19.01	83	61	0.00	18.14	77	57	0.95	13.82	66	47	0.00	14.69
29	88	72	0.00	20.74	83	65	0.00	14.69	77	53	0.00	16.42	70	51	0.00	12.10
30	89	71	0.00	19.87	85	65	0.00	17.28	78	53	0.00	15.55	73	52	0.00	12.10
31					86	62	0.00	15.55					75	58	0.00	12.96
Avg	88	74		16.07	86	66		17.09	81	59		14.77	72	51		11.29
Max	96	79	4.11	23.33	91	73	0.78	21.60	89	71	0.95	19.01	85	66	2.76	15.55
Min	82	69	0	3.46	79	53	0	6.05	71	47	0	8.64	54	34	0	0.86

Total			16.36	482.12			0.79	529.64			1.32	443.24			3.86	349.92	

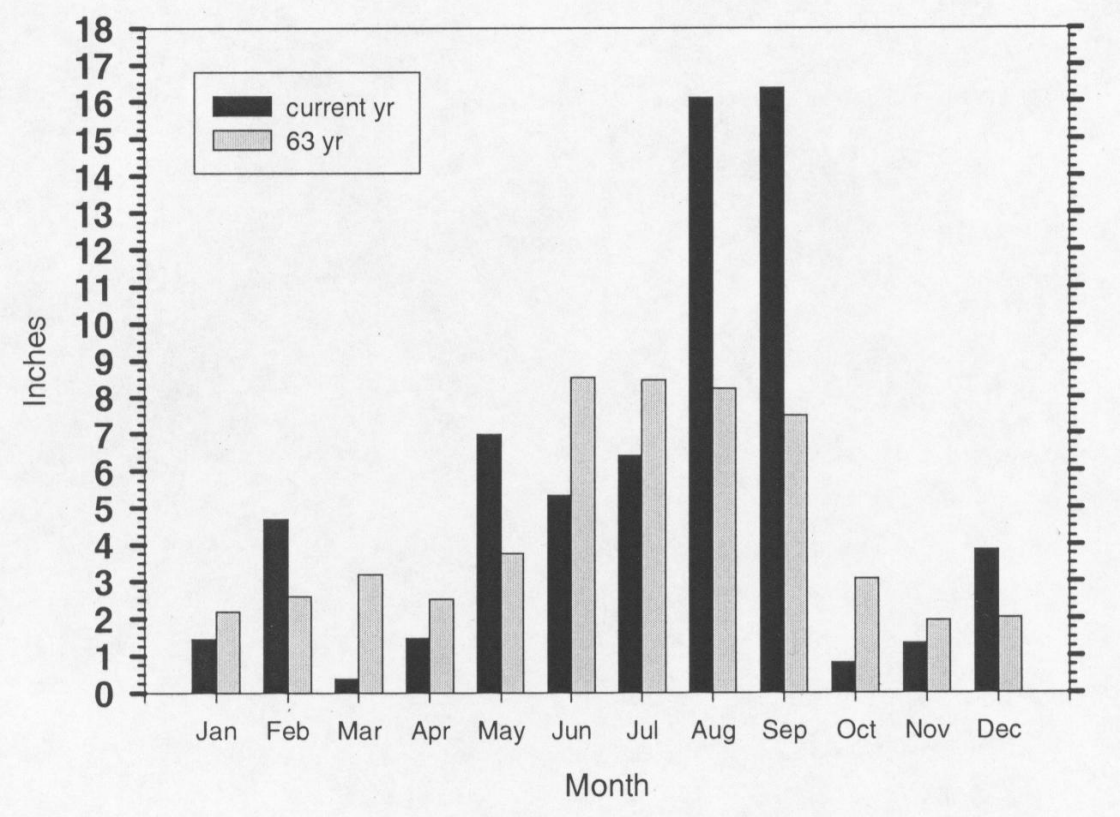

Figure 1. Rainfall in 2004 compared with the 63-year mean.

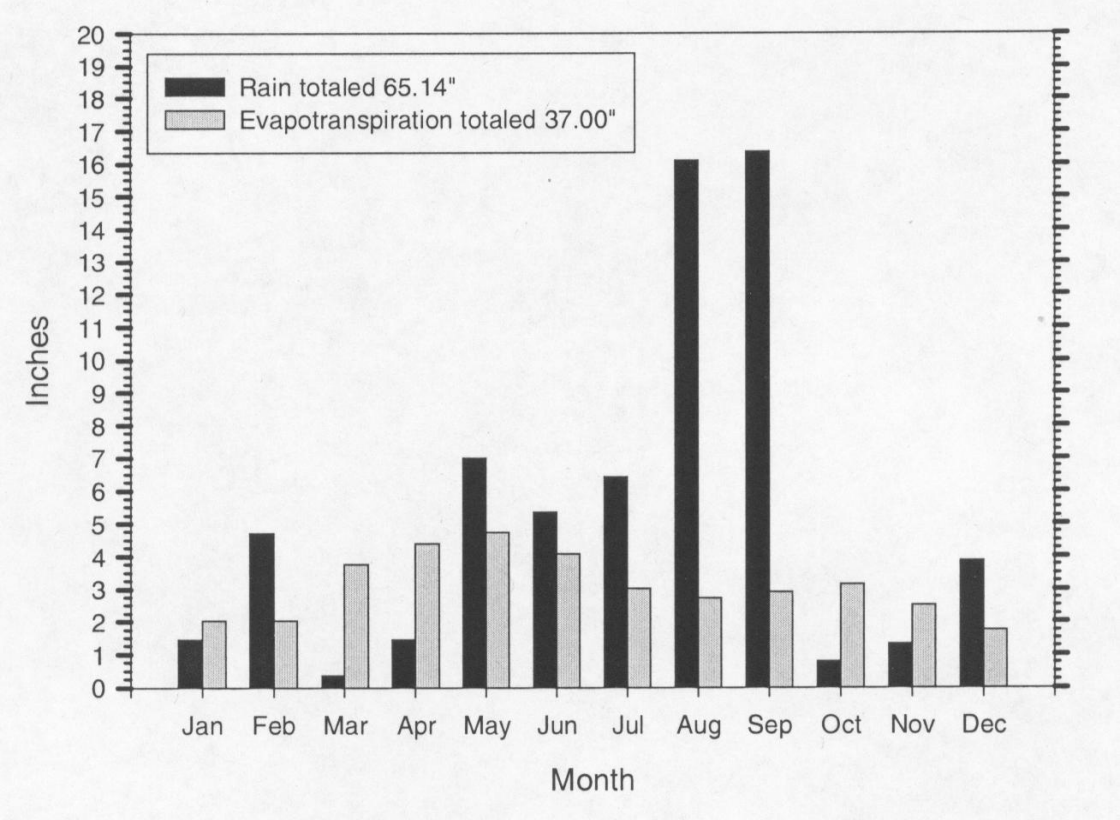

Figure 2. Monthly rainfall compared with evapo-transpiration during 2004.

Evapo-transpiration

Evapo-transpiration exceeded rainfall in five months during 2004 (Figure 2). This was typical because evapo-transpiration generally exceeds rainfall in January to May and October to December, which are months with limited rainfall. For the year, rainfall exceeded evapo-transpiration by 28.14 inches.

Temperature:

There was 1 d when daily-low shelter temperature was at or below 32 °F and 4 d when low ground temperature reached freezing (Table 2). The extreme low temperature for 2004 occurred on 29 January when shelter and ground temperature reached 32 and 29 °F, respectively. Scattered frost occurs when ground temperature reaches 35 °F. Based on this observation, there were 4 incidences of frost (data not shown). Except for January and April, all months in 2004 had higher mean low temperatures compared with the 61-yr means (Table 3). August and September were especially warm, perhaps due to tropical storm activity. Overall, mean temperature for 2004 was 1 °F higher than the 61-year mean.

Table 3. Summary of minimum temperature (°F)* by months, Range Cattle REC.

	Shelter					Ground level	
	1944-04	2004	1944-04		2004	2004	
	Avg. Low	Avg. Low	Extreme Low	Year	Extreme Low	Avg. Low	Extreme Low
January	49.3	48.2	18	1981	32	45.8	29
February	50.7	54.4	26	1976	35	52.3	32
March	54.6	55.7	26	1980	41	52.1	37
April	58.2	55.6	34	1971	42	52.3	39
May	63.3	64.8	43	1945	57	62.2	54
June	69.0	70.1	52	1984	66	68.0	64
July	71.2	71.7	62	several	66	70.0	65
August	71.8	73.3	61	1977	71	72.4	70
September	71.1	73.8	56	1962	69	72.1	67
October	64.8	66.2	42	several	53	63.7	49
November	57.0	58.9	25	1970	47	56.9	43
December	51.2	51.3	20	1962	34	48.9	31
Avg.	61.0	62.0			51.1	59.7	48.3

* °C = (°F - 32) x 0.555

Solar Radiation:

Daily solar radiation is shown in Table 2, and 2004 total monthly solar radiation can be seen graphically in Figure 3. For interpretation of solar radiation as it pertains to plant growth, 1 MJ results in about 14.3 lb/A of plant dry matter if soil water, temperature, and fertility are not limiting and vegetative cover is complete. Theoretically, enough solar radiation was received in May 2004 (757 MJ) to produce 10,825 lb/A of plant dry matter. Total solar radiation for 2004 was 6568 MJ.

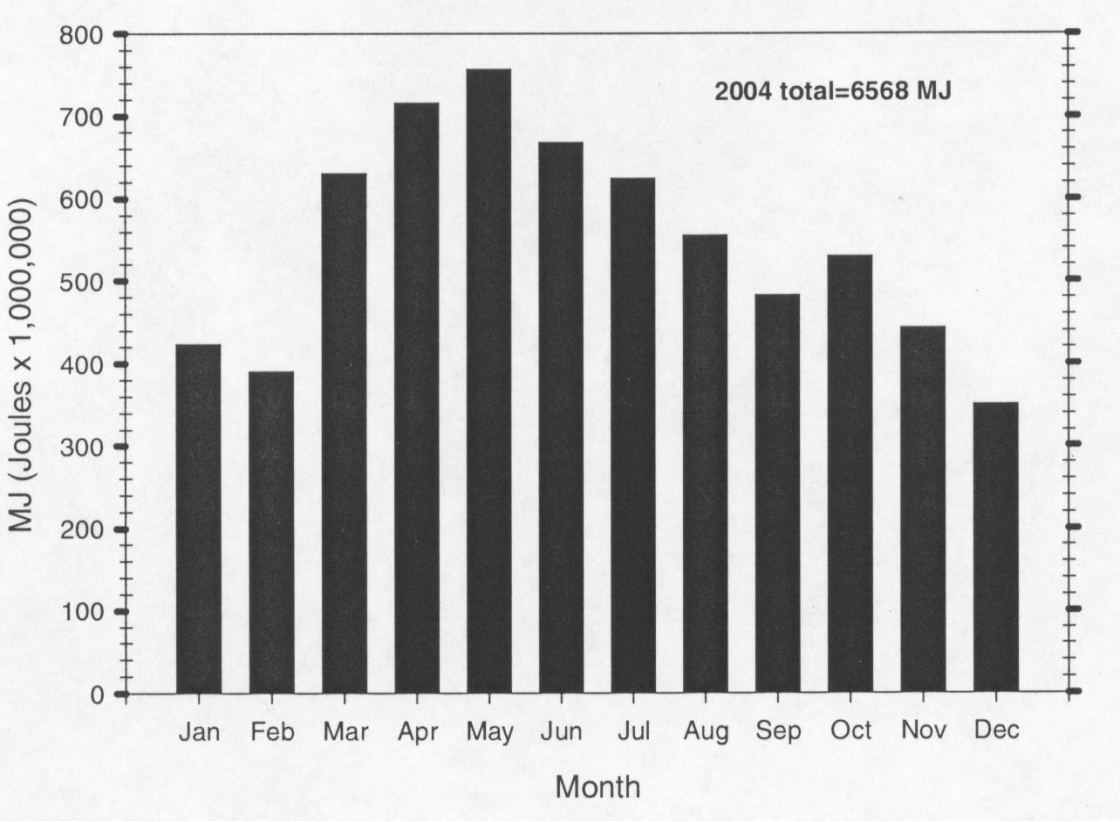

Figure 3. Total monthly solar radiation for 2004.

Freeze hazard:

The fall and spring freeze hazards for the Range Cattle REC are shown in Figures 4 and 5, respectively. The fall freeze hazard shows the chance of experiencing the first attainment of a critical temperature before a selected date, while the spring freeze hazard shows the chance of the last attainment of a critical temperature before a critical date. Based on records from 1944 to 1991, these data will not predict what will occur in a given year, but what can be expected over a period of years. In an example using the spring freeze hazard, a frost susceptible crop (assuming 32°F) planted before the 1st of February would stand a 50% chance of survival (Figure 4). A grower would probably lose five crops over 10 years by planting before the 1st of February.

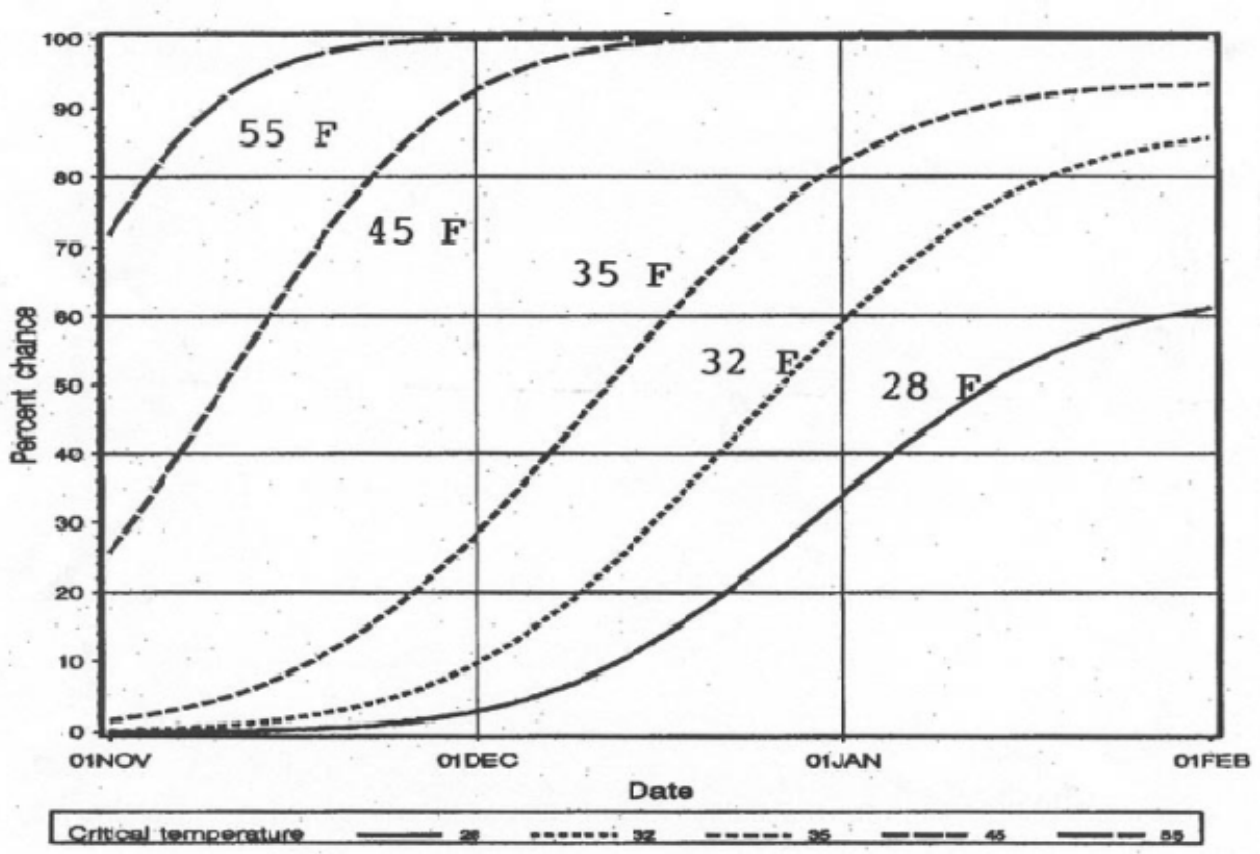

Figure 4. Fall freeze hazard showing the chance of the <u>first</u> attainment of a given temperature <u>before</u> a selected date.

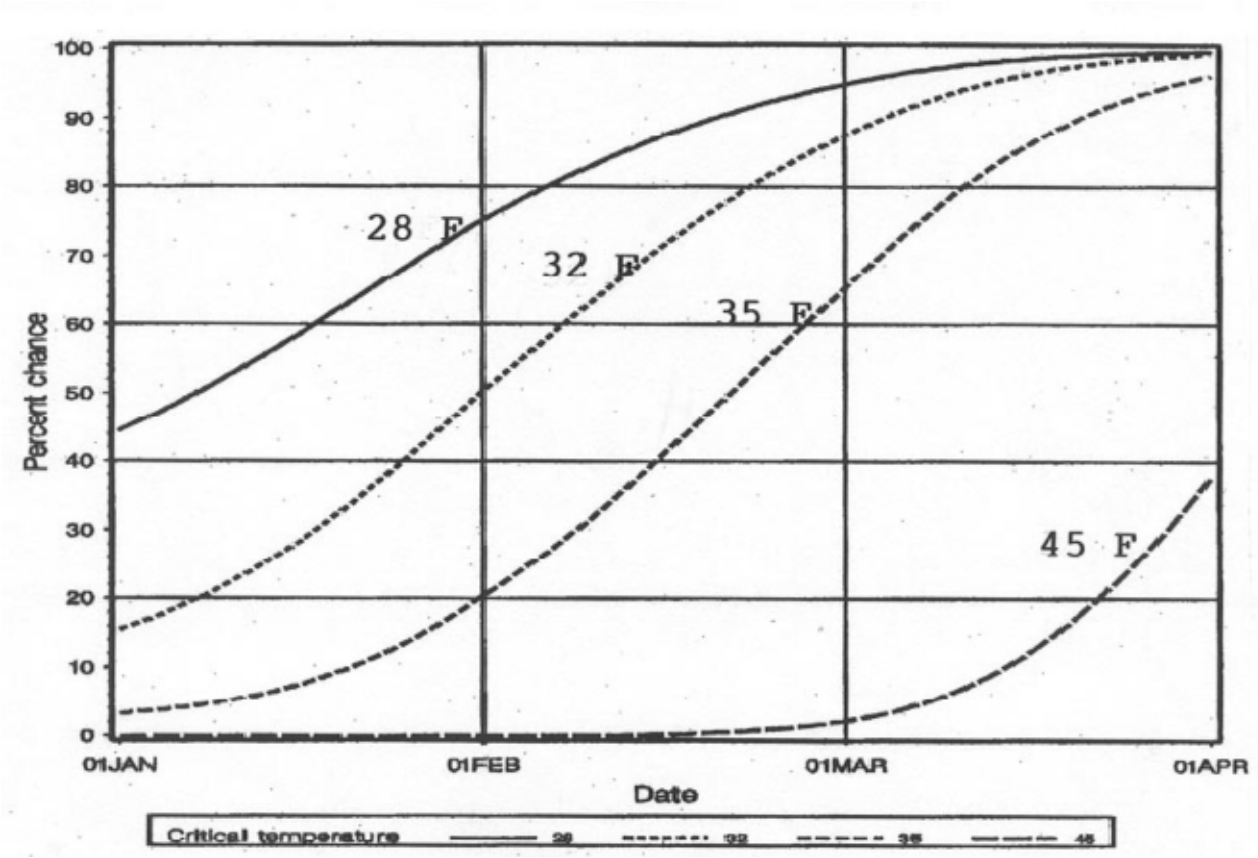

Figure 5. Spring freeze hazard showing the chance of the last attainment of a given temperature before a selected date.

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